# AIRS Development Status at NCEP

Stephen Lord

John Derber, R. Treadon,

P. van Delst, Y. Tahara

NCEP Environmental Modeling Center

# Parallel system

- T254/L64
- Uses AIRS data available by operational cut-offs
  - 2:45hr after analysis time - early analysis (forecasts)
  - 6hr after analysis time – final analysis (assimilation)
- Early analysis used as guess solution for final analysis
- 6 hr cycle (analysis every 3 hrs using data from +/- 3 hr)

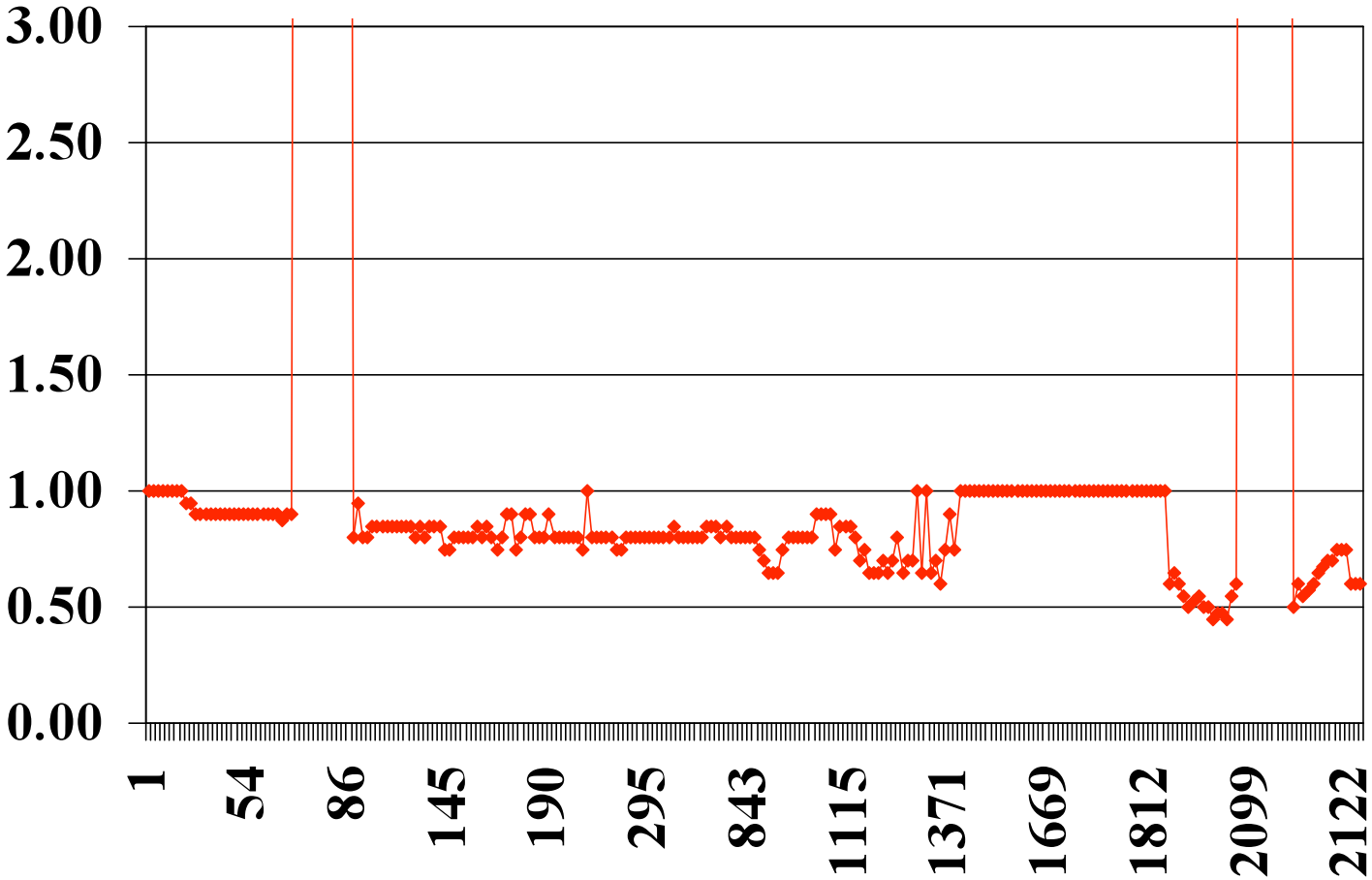
# Parallel system

- Uses assimilation system in final testing for operational implementation (control)
  - Improved time interpolation – allows use of more frequent output fields – time interpolates surface fields
  - Allows use of guess solution – early analysis can be used for GFS
  - New RT (Tahara's version)
  - Monitoring file upgrade
    - http://wwwt.emc.ncep.noaa.gov/gmb/gdas/radiance/prx/index.html (control)
    - http://wwwt.emc.ncep.noaa.gov/gmb/gdas/radiance/prq/index.html (AIRS)
  - Streamline code and include a few bug fixes
  - AIRS modifications
    - Data handling
    - Cloud height/% detection
    - QC
  - New surface emissivity model (vanDelst)

# Parallel System

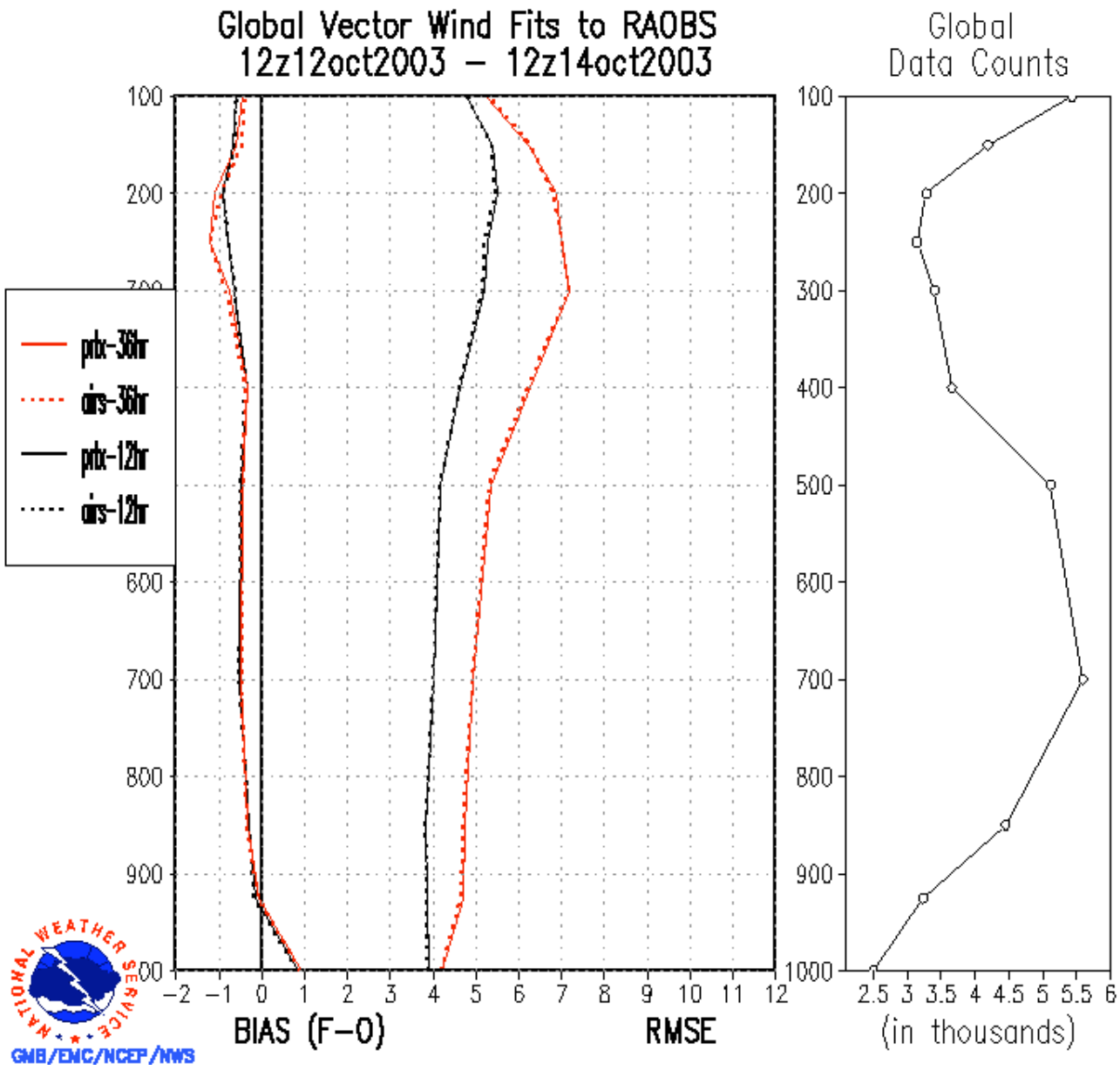
- Data usage
- 254 out of 281 channels used
  - 73-86 removed (Channels peak too high)
  - 1937-2109 removed (non-LTE)
  - 2357 removed (Large obs-background diffs)
- Shortwave channels downweighted (wavenumber > 2000) or removed (wavenumber > 2400) during day
  - Can’t simulate reflected solar radiation

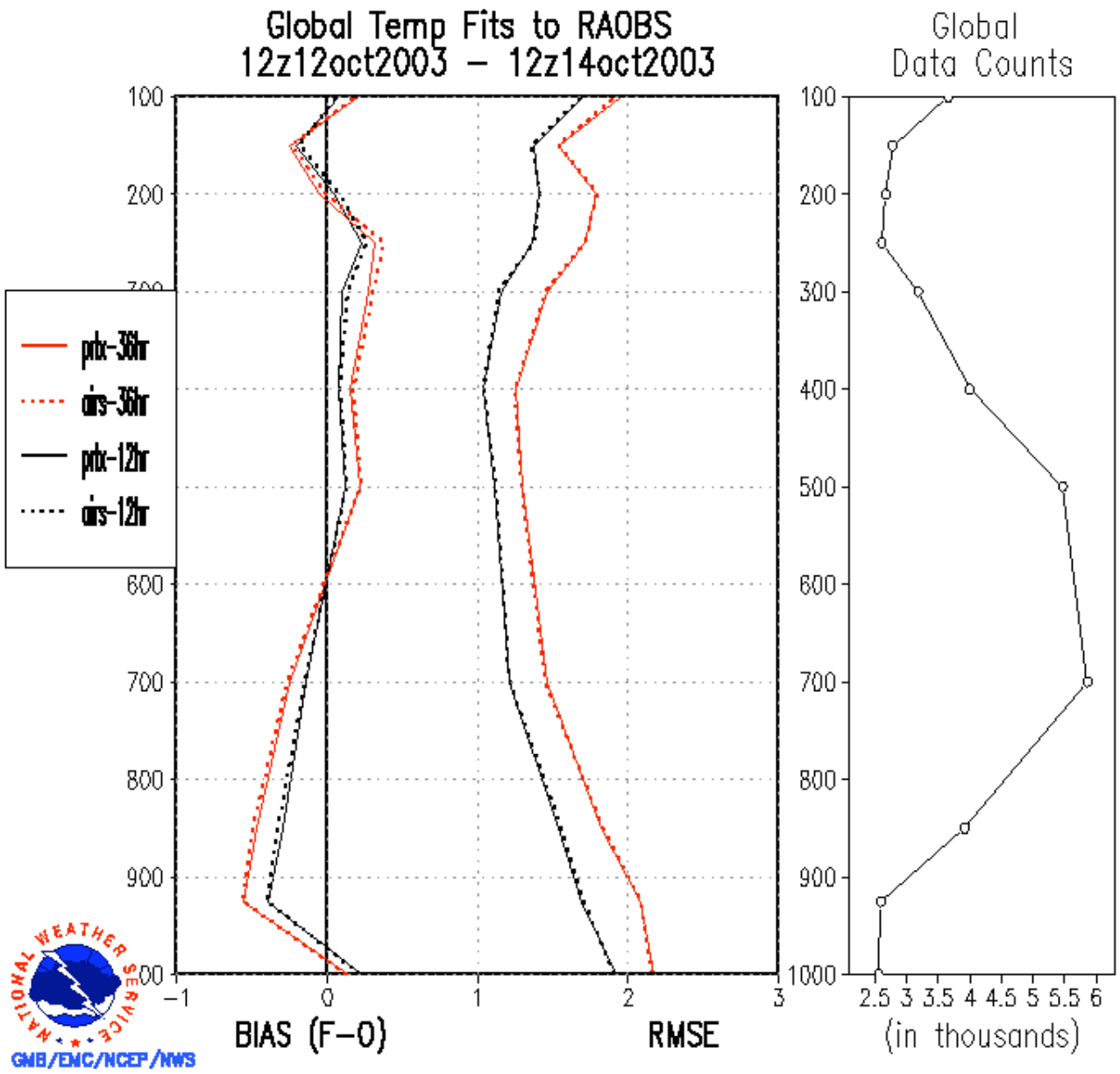
# AIRS observational errors

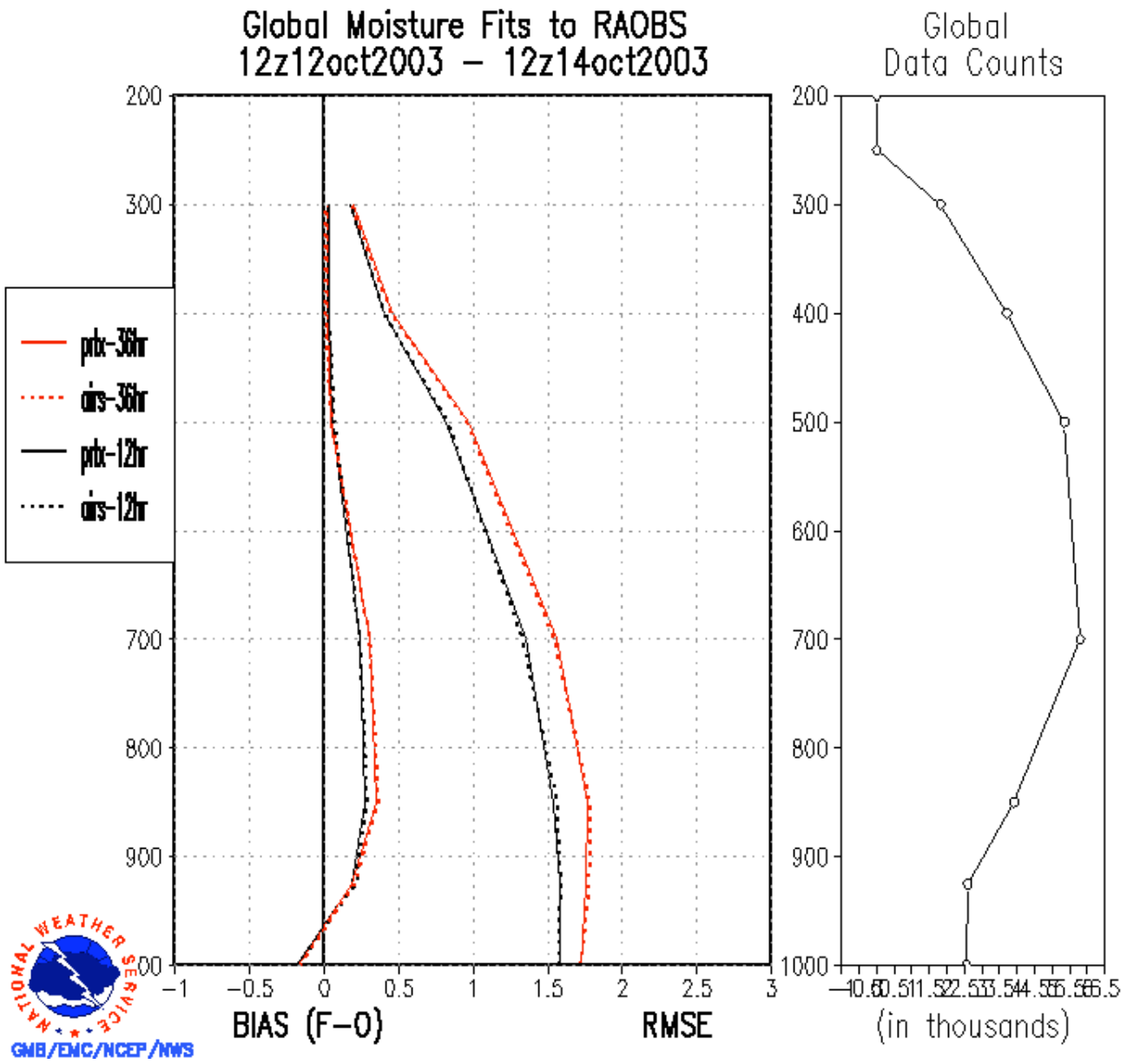


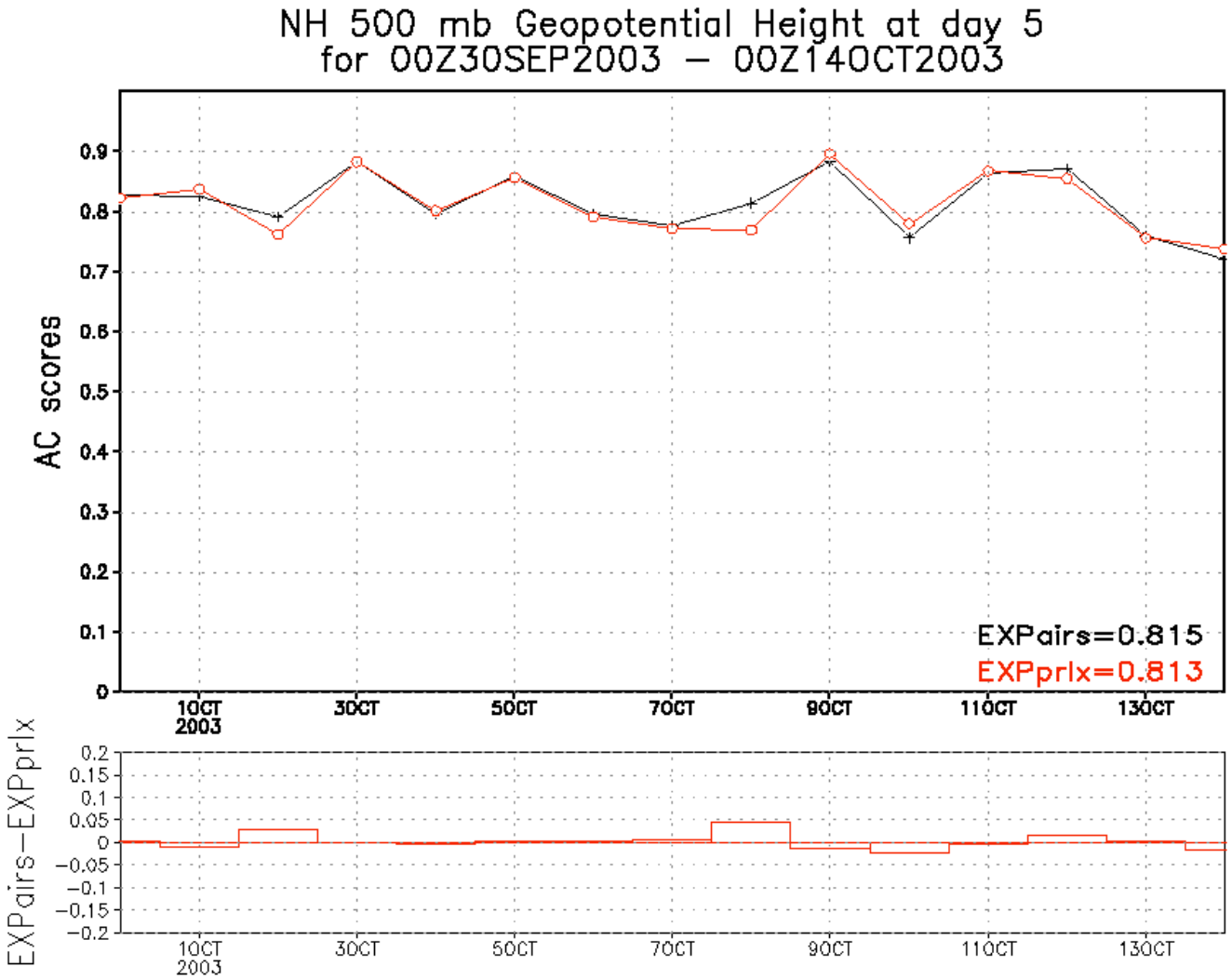
# Parallel testing

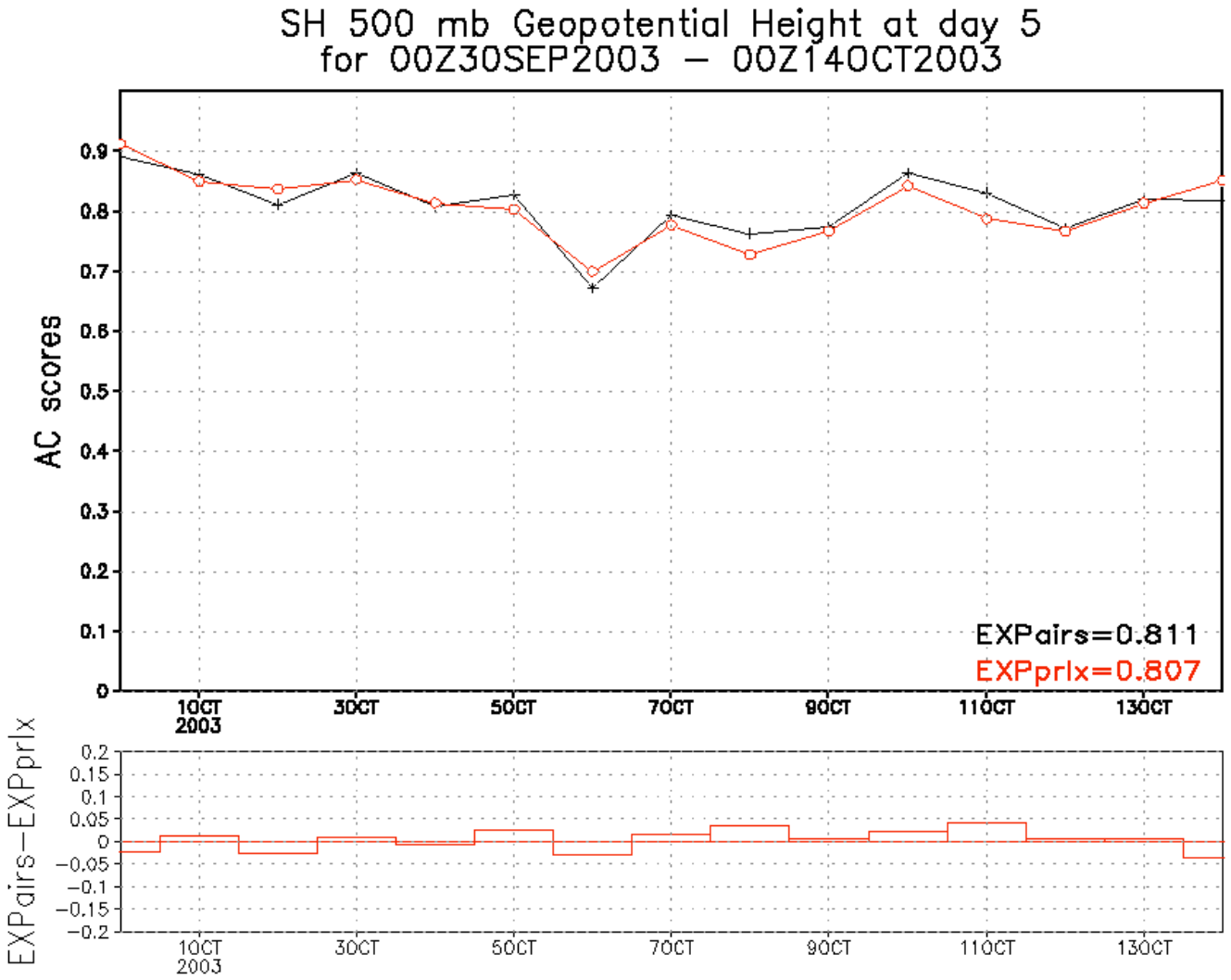
- Testing of system and data impact
- System updated as problems uncovered
- Recent changes (not present in results shown)
  - Removal of channel 2357 – poor accuracy
  - Thinning to 225km vs. 150km – poor convergence (AIRS penalty too large)

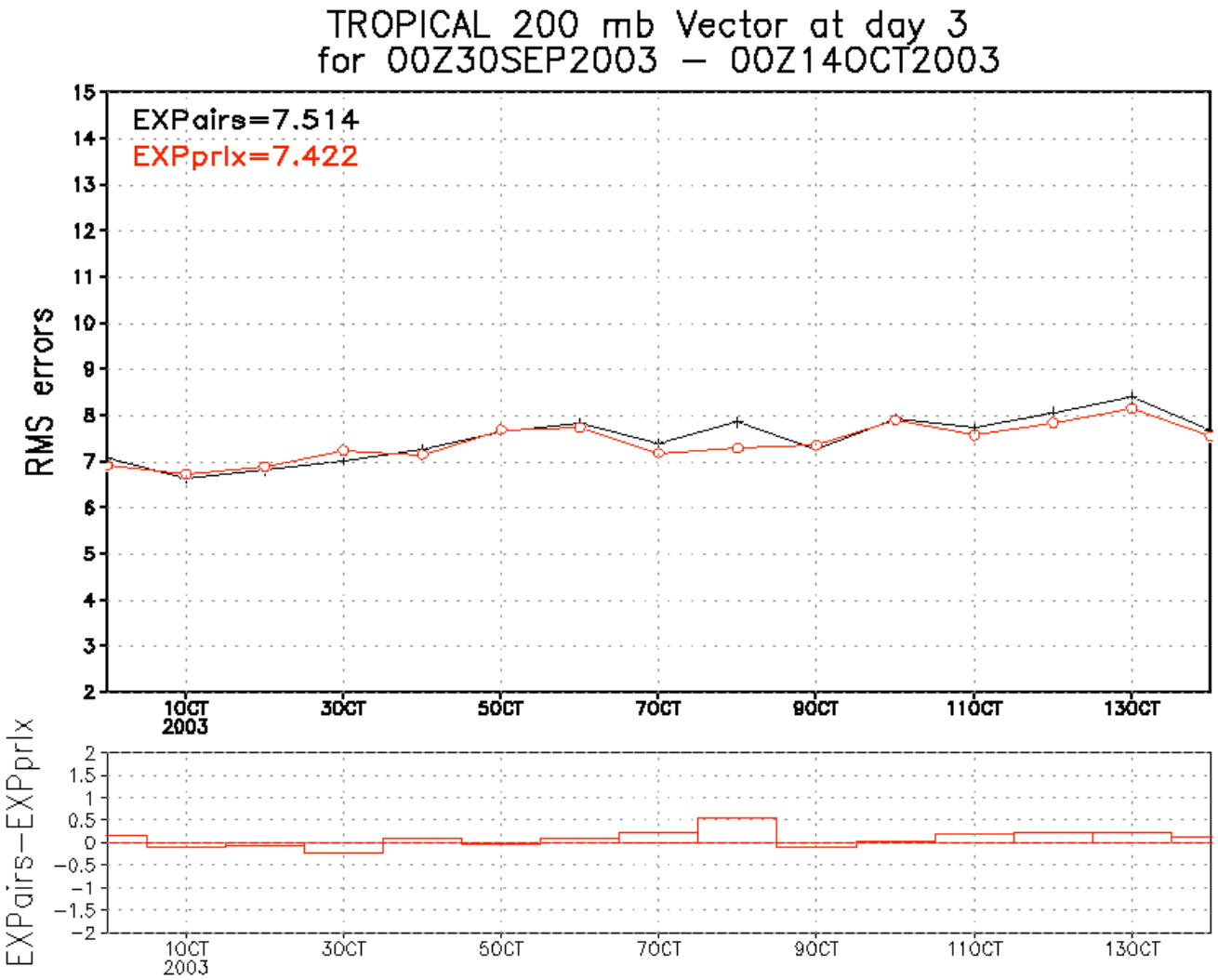

Global Vector Wind Fits to RAOBS
12z12oct2003 – 12z14oct2003
Global
Data Counts
ptkr-36hr
oins-36hr
ptkr-12hr
oins-12hr
100
200
300
400
500
600
700
800
900
1000
−2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12
BIAS (F−O)
RMSE
2.5 3 3.5 4 4.5 5 5.5 6
(in thousands)
NATIONAL WEATHER SERVICE
GMB/EMC/NCEP/NWS

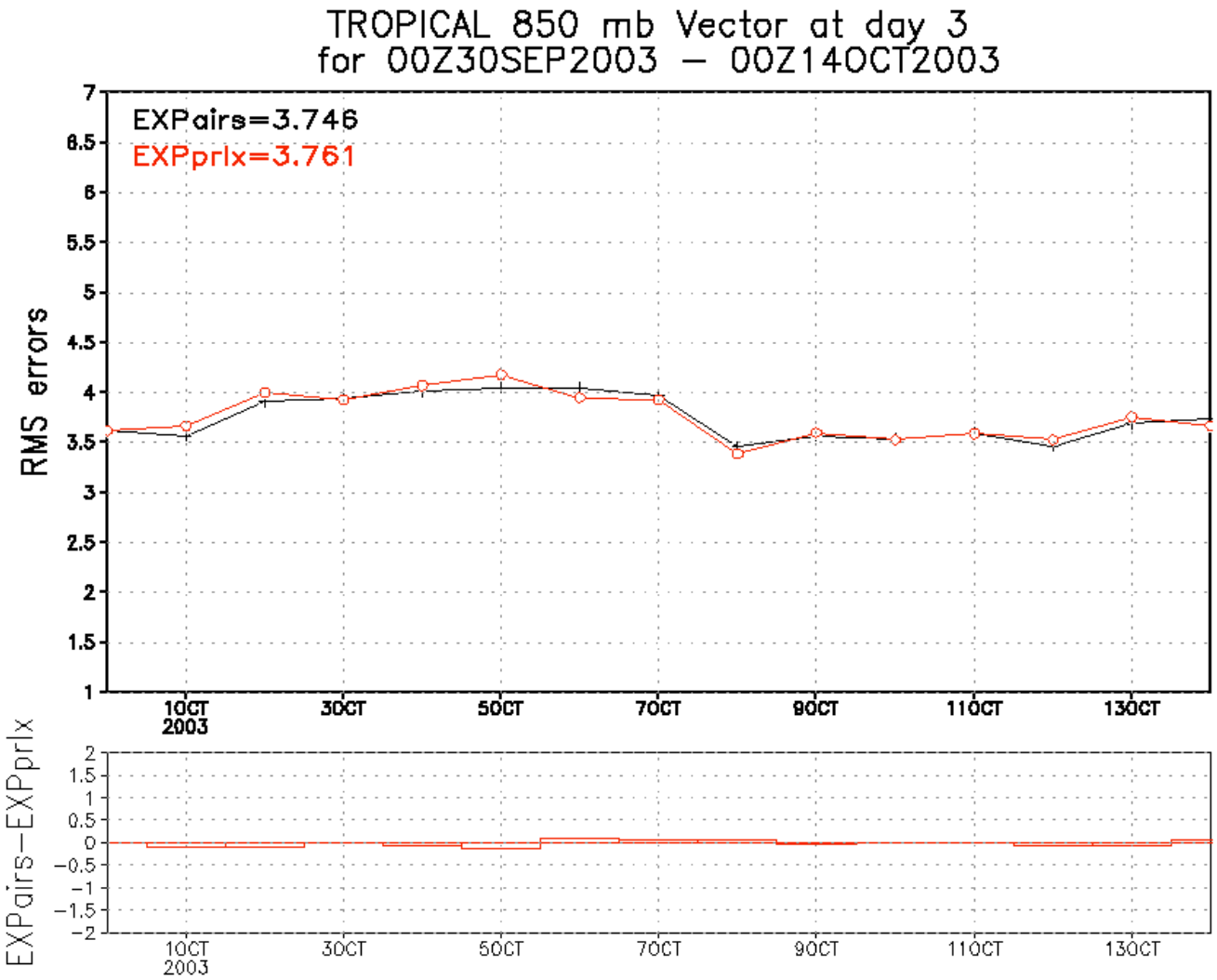

Global Temp Fits to RAOBS
12z12oct2003 – 12z14oct2003
Global
Data Counts
pntx-36hr
cmrs-36hr
pntx-12hr
cmrs-12hr
100
200
300
400
500
600
700
800
900
1000
−1
0
1
2
3
BIAS (F−O)
RMSE
2.5 3 3.5 4 4.5 5 5.5 6
(in thousands)
NATIONAL WEATHER SERVICE
GMB/EMC/NCEP/NWS


Global Moisture Fits to RAOBS
12z12oct2003 – 12z14oct2003
Global
Data Counts
ptkx-36hr
oiws-36hr
ptkx-12hr
oiws-12hr
200
300
400
500
600
700
800
900
1000
−1
−0.5
0
0.5
1
1.5
2
2.5
3
BIAS (F−O)
RMSE
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
(in thousands)
NATIONAL WEATHER SERVICE
GMB/EMC/NCEP/NWS


NH 500 mb Geopotential Height at day 5
for 00Z30SEP2003 – 00Z14OCT2003
AC scores
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
EXPairs=0.815
EXPprlx=0.813
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT
EXPairs–EXPprlx
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT


SH 500 mb Geopotential Height at day 5
for 00Z30SEP2003 – 00Z14OCT2003
AC scores
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
EXPairs=0.811
EXPprlx=0.807
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT
EXPairs–EXPprlx
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT


TROPICAL 200 mb Vector at day 3
for 00Z30SEP2003 – 00Z14OCT2003
EXPairs=7.514
EXPprlx=7.422
RMS errors
15
14
13
12
11
10
9
8
7
6
5
4
3
2
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT
EXPairs–EXPprlx
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT


TROPICAL 850 mb Vector at day 3
for 00Z30SEP2003 – 00Z14OCT2003
EXPairs=3.746
EXPprlx=3.761
RMS errors
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT
EXPairs–EXPprlx
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
10CT
2003
30CT
50CT
70CT
90CT
110CT
130CT

# Additional possible uses for AIRS data

- New SST analysis being developed which will directly use radiances in analysis system
- Initial development with AVHRR data
- Extensions to include microwave, geostationary and AIRS data

# Summary

- Parallel testing has begun at NCEP
- Results are first attempt at full resolution, with cycling
- Some minor initial adjustments have been made to system (and more may be made in future).
- Initial results show small positive/neutral impact
- Testing will continue and additional improvements and uses (such as for SST and cloud analysis) will be developed

# Lessons learned from AIRS

- Long term support for development of data assimilation prior to launch essential
- Data format should be worked out with users as early as possible
- Production of simulated data prior to real data availability allows development of data stream
- Consistency in use of data and formats greatly simplifies problem
- Impact of data is difficult to predict in advance

# Skin temperature impact of AIRS 2003101200